

REMARKS

The application has been amended and is believed to be in condition for allowance.

This amendment is being filed as part of an RCE application.

There are no formal matters outstanding.

Claims 15-27 were rejected as obvious over FERAL et al. 5,703,425 in view of PHILLIPS 6,476,542 and INOUE et al. 5,438,232.

The claims have been amended to recite the additional ceramic layer being a diffusion barrier layer. Support for this recitation is discussed below.

In addressing the claims, a review of the invention may prove helpful. The claimed invention is a ceramic element with at least one substantially homogenous ceramic layer.

To achieve this object, a ceramic element with at least one substantially homogenous ceramic layer is specified. The ceramic element is characterized in that the ceramic layer has a plurality of homogenous partial ceramic layers arranged one on top of the other.

This device is achieved by a method of a) arranging homogenous partial ceramic layers one on top of the other to form a stack and b) compacting the stack, thereby forming the ceramic element with the ceramic layer.

A homogenous partial ceramic layer comprises a single phase formed from a single ceramic material so that there is no sudden change and almost no gradient in the composition of the ceramic material in the partial ceramic layer. Subsequent laminating and sintering of the stack of green films produce the ceramic element with the homogenous ceramic layer comprising sintered homogenous partial ceramic layers. The partial ceramic layers comprise the sintered ceramic.

In one embodiment at least one of the partial ceramic layers has a partial layer thickness selected from the range 5 μm to 250 μm inclusive. The homogenous ceramic layer has an overall layer thickness selected from the range 10 μm to 5 mm inclusive.

In a further embodiment, at least one electrode layer is arranged on at least one surface section of the homogenous ceramic layer with at least one further electrode layer arranged on at least one further surface section such that the electrode layers are opposite each other and the ceramic layer is arranged between the electrode layers. At least one of the electrode layers is arranged between the ceramic layer and at least one further ceramic layer (13 of Figure 2).

The electrode layer and the further ceramic layer are particularly advantageous in relation to lead zirconate titanate. Each of these layers can act as a diffusion barrier for the said volatile components of the lead zirconate titanate (specification page 9, beginning at line 12).

The ceramic material 6 may be lead zirconate titanate. The ceramic element 1 may be a piezo-electric bending transducer 12 (Figure 2). The homogenous ceramic layer of the bending transducer comprises five homogenous partial ceramic layers with partial layer thicknesses of around 20 μm . To maximize deflection, the electrode layers 8 and 10 are applied up to an edge of the homogenous ceramic layer 2 and therefore to a lateral surface section 17.

The electrode layers 8 and 10 are largely covered by a further ceramic layer 13 each. The layer thickness of the further ceramic layers 13 is around 10 μm . Electrical contact is achieved by an electrical through contact 15 (Figure 3B), or via a freely accessible free contact area 16 of the respective electrode layer 8 and 10 not covered by the further ceramic layer 13 (Figure 3C).

The Applied Art

FERAL in view of PHILLIPS and INOUE do not teach of such the recited ceramic element having the diffusion barrier as now recited. In particular, the references are not found to teach the piezo-ceramic (6) as a lead zirconate titanate and the diffusion barrier for diffusing volatile components of the lead zirconate titanate, nor are these references seen as having the particular combination of features of the newly-added claims.

FERAL is acknowledged not to include the recited further and still further ceramic layers, elements 13 of application Figures 1-2.

PHILLIPS is not offered for this feature.

INOUE does not teach the further ceramic layer and the still further ceramic layer each having a thickness around 10 μm and less than the thicknesses of each partial layer. See that layers 3 of the INOUE figures are clearly significantly thicker than the intermediate layers.

Additionally, the claims, e.g., claim 28, recite a diffusion barrier for volatile components of lead zirconate titanate, the diffusion barrier comprised of i) a second electrode layer (10) arranged on a lowermost surface of the homogenous ceramic layer, and ii) a further ceramic layer (13) arranged so that the second electrode layer (10) is intermediate the further ceramic layer (13) and the lowermost surface of the homogenous ceramic layer. Applicants do not see this arrangement being taught or suggested in the applied art.

Applicants also do not see the applied art teaching the ceramic element as a piezo-electric bending transducer, the partial layers of the plurality of homogenous partial ceramic layers number five and are of lead zirconate titanate with a partial layer thickness of around 20 μm , and the first and second electrode layers (8, 10) extend to an edge of an adjacent surface

of the homogenous ceramic layer covering a lateral surface section of the homogenous ceramic layer.

Applicants also do not see the applied art (e.g., INOUE) teaching an electrical contact (15) extending through the still further ceramic layer or a pair of electrical contacts located at a freely accessible free contact area (16) of the first and second electrode layers not covered by the further ceramic layer and the still further ceramic layer.

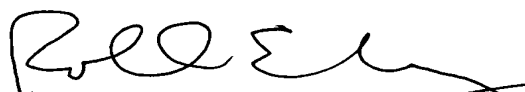
Thus, these dependent claims are also believed patentable.

Accordingly, reconsideration and allowance are respectfully requested.

The Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 25-0120 for any additional fees required under 37 C.F.R. § 1.16 or under 37 C.F.R. § 1.17.

Respectfully submitted,

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